WHAT IS CLAIMED IS:

1. A system for determining decoupling components for a power distribution system, said power distribution system including a voltage regulator module, the system comprising:

    a database of characteristic values for a plurality of decoupling components; and

    a computer system configured to:

    access said database of characteristic values for said plurality of decoupling components;

    accept known system parameters for said power distribution system;

    simulate a voltage regulator circuit using a mathematical model of said voltage regulator circuit, wherein simulating said voltage regulator circuit includes:

      simulating a voltage with a voltage source model;

      simulating ramping up or ramping down of current in said voltage regulator circuit with a model of a slew inductor; and

      simulating effects of output inductance on said voltage regulator circuit with a model of an output inductor;

    select one or more different decoupling components based on said known system parameters for said power distribution system and entries in said data base;

    calculate a specific quantity for selected decoupling components, said selected decoupling components selected from said database based on known system parameters; and

    determine a location of placement within said power distribution system for each of said selected decoupling components based on said known system parameters and said entries in said database.

2. The system as recited in claim 1, wherein said decoupling components are capacitors, and wherein characteristics of each of said capacitors includes a rated capacitance value, a mounted inductance value, and an equivalent series resistance (ESR) value.

3. The system as recited in claim 2, wherein said computer system is further configured to:

obtain an estimate of a bulk capacitance value for said power distribution system;

perform a cyclical simulation of said power distribution system, wherein said cyclical simulation comprises simulating the operation of said power distribution system over a plurality of clock cycles;

refine said bulk capacitance value based on results obtained during said cyclical simulation.

4. The system as recited in claim 3, wherein said computer system is further configured to analyze a transient response of said power distribution system during said cyclical simulation.

5. The system as recited in claim 4, wherein said computer system is further configured to analyze stability of said power distribution system during said cyclical simulation.

6. The system as recited in claim 3, wherein said computer system is configured to simulate an output resistor of said voltage regulator circuit, wherein simulating said output resistor simulates effects of resistance between the output of said voltage regulator circuit and a load coupled to said voltage regulator circuit.

7. The system as recited in claim 6, wherein said computer system is configured to simulate the effects of equivalent series resistance of a capacitor in said voltage regulator circuit with a model of a decoupling resistor.

8. The system as recited in claim 3, wherein said known system parameters for said power distribution system comprise one or more of the following:
one or more power supply characteristics;
load characteristics;
one or more voltage regulator circuit characteristics;
allowable voltage ripple;
total current consumption;
physical location constraints;
weighting factors; or
a frequency range for a target impedance of said power distribution system.

9. The system as recited in claim 3, wherein said voltage regulator circuit is configured to receive a first voltage as an input, and to output a second voltage, wherein said first voltage and said second voltage are not identical.

10. The system as recited in claim 9, wherein said mathematical model of said voltage regulator circuit is a simplified model, and wherein said voltage regulator circuit is a switching voltage regulator.

11. The system as recited in claim 3, wherein said system is further configured to calculate one or more electrical characteristic values at one or more specified physical locations within said power distribution system.

12. The system as recited in claim 3, wherein said system is further configured to generate a resultant bill of goods, said bill of goods including a specific quantity of each of said selected decoupling components and information concerning location of physical placement of said selected decoupling components within said power distribution system.

13. A method for determining a specific quantity and physical location of decoupling components within a power distribution system, the method comprising:

selecting decoupling components from a database, wherein said database includes characteristic values for a plurality of different decoupling components;

determining a target impedance for said power distribution system;

simulating the operation of said power distribution system, wherein said power distribution system includes a voltage regulator circuit coupled to a load, and wherein said simulation comprises:

simulating the operation of said voltage regulator circuit using a model of said voltage regulator circuit;

obtaining an estimate of a bulk capacitance value for said power distribution system;

performing a cyclical simulation of said power distribution system, wherein said cyclical simulation includes simulating the operation of said power distribution system for a plurality of clock cycles;

refining said bulk capacitance value based on results obtained during said cyclical simulation;

selecting one or more of said different decoupling components based on said bulk capacitance obtained during said simulating the operation of said power distribution system and one or more electrical characteristic values for each of said decoupling components.

14. The method as recited in claim 13, wherein said simulating the operation of said power distribution system includes analyzing at least one transient response during said cyclical simulation.

15. The method as recited in claim 14, wherein said simulating the operation of said power distribution system includes analyzing the stability of said power distribution system.

16. The method as recited in claim 13, wherein said decoupling components are capacitors, and wherein characteristics of each of said capacitors includes a rated capacitance value, a mounted inductance value, and an equivalent series resistance (ESR) value.

17. The method as recited in claim 13, wherein said model of said voltage regulator circuit is a mathematical model, wherein said mathematical model comprises:

a voltage source model, wherein said voltage source model is configured for simulating a voltage source for said power distribution system;

a slew inductor model, wherein said slew inductor model is configured for simulating a ramping up or a ramping down of current in said voltage regulator circuit;

an output inductor model, wherein said output inductor model is configured for simulating effects of output inductance on said voltage regulator circuit;

a decoupling resistor model, wherein said decoupling resistor model is configured to simulate the effects of an equivalent series resistance of a capacitor in said voltage regulator circuit; and

an output resistor model, wherein said output resistor model is configured for simulating effects of resistance between an output of said voltage regulator circuit and said load.

18. The method as recited in claim 17, wherein said mathematical model of said voltage regulator circuit is a simplified model, and wherein said voltage regulator circuit is a switching voltage regulator.

19. The method as recited in claim 18, wherein said mathematical model of said voltage regulator circuit is a SPICE model.

20. The method as recited in claim 18, wherein said voltage regulator circuit is configured to receive a first voltage as an input, and to output a second voltage, wherein said first voltage and said second voltage are not identical.

21. The method as recited in claim 13 further comprising selecting said decoupling components based on known system parameters, wherein said known system parameters include one or more of the following:
one or more power supply characteristics;
load characteristics;
one or more voltage regulator circuit characteristics;
allowable voltage ripple;
total current consumption;
physical location constraints;
weighting factors; or
a frequency range for a target impedance of said power distribution system.

22. The method as recited in claim 21 further comprising calculating one or more electrical characteristic values at one or more specified physical locations within said power distribution system.

23. The method as recited in claim 22 further comprising generating a resultant bill of goods, said bill of goods including a specific quantity of each of said decoupling components selected from said database and information concerning location of physical placement of said decoupling components within said power distribution system.

24. The method as recited in claim 23 further comprising:

changing said specific quantity for any of said decoupling components selected from said database, wherein said changing is based on said refining said bulk capacitance value; and

recalculating placement of said decoupling components at a specific location within said power distribution system, wherein said recalculating is based upon said known system parameters for said power distribution system, electrical characteristic values for said decoupling components, and said changing specific quantity for any of said decoupling components.

25. A system for determining decoupling components for a power distribution system, said power distribution system including a voltage regulator module, the system comprising:

a database of characteristic values for a plurality of decoupling components; and

a computer system configured to:

access said database of characteristic values for said plurality of decoupling components;

accept known system parameters for said power distribution system;

simulate a voltage regulator circuit using a SPICE model of said voltage regulator circuit, wherein simulating said voltage regulator circuit includes:

simulating a voltage with a SPICE model of a voltage source;

simulating ramping up or ramping down of current in said voltage regulator circuit with a SPICE model of a slew inductor; and

simulating effects of output inductance on said voltage regulator circuit with a SPICE model of an output inductor;

select one or more different decoupling components based on said known system parameters for said power distribution system and entries in said data base;

calculate a specific quantity for selected decoupling components, said selected decoupling components selected from said database based on known system parameters; and

determine a location of placement within said power distribution system for each of said selected decoupling components based on said known system parameters and said entries in said database.

26. The system as recited in claim 25, wherein said decoupling components are capacitors, and wherein characteristics of each of said capacitors includes a capacitance value, a mounted inductance value, and an equivalent series resistance (ESR) value.

27. The system as recited in claim 26, wherein said computer system is further configured to:

obtain an estimate of a bulk capacitance value for said power distribution system;

perform a cyclical simulation of said power distribution system, wherein said cyclical simulation comprises simulating the operation of said power distribution system over a plurality of clock cycles;

refine said bulk capacitance value based on results obtained during said cyclical simulation.

28. The system as recited in claim 27, wherein said computer system is further configured to analyze a transient response of said power distribution system during said cyclical simulation.

29. The system as recited in claim 28, wherein said computer system is configured to analyze stability of said power distribution system during said cyclical simulation.

30. The system as recited in claim 27, wherein said computer system is configured to simulate the effects of an output resistance from a load coupled to said voltage regulator circuit using a SPICE model of an output resistor.

31. The system as recited in claim 30, wherein said computer system is configured to simulate the effects of an equivalent series resistance from a capacitor in said voltage regulator circuit using a SPICE model of a decoupling resistor.

32. The system as recited in claim 27, wherein said known system parameters for said power distribution system comprise one or more of the following:

one or more power supply characteristics;

load characteristics;

one or more voltage regulator circuit characteristics;

allowable voltage ripple;
total current consumption;
physical location constraints;
weighting factors; or
a frequency range for a target impedance of said power distribution system.

33. The system as recited in claim 27, wherein said voltage regulator circuit is configured to receive a first voltage as an input, and to output a second voltage, wherein said first voltage and said second voltage are not identical.

34. The system as recited in claim 33, wherein said SPICE model of said voltage regulator circuit is a simplified model, and wherein said voltage regulator circuit is a switching voltage regulator.

35. The system as recited in claim 27, wherein said system is further configured to calculate one or more electrical characteristic values at one or more specified physical locations within said power distribution system.

36. The system as recited in claim 27, wherein said system is further configured to generate a resultant bill of goods, said bill of goods including a specific quantity of each of said selected decoupling components and information concerning location of physical placement of said selected decoupling components within said power distribution system.